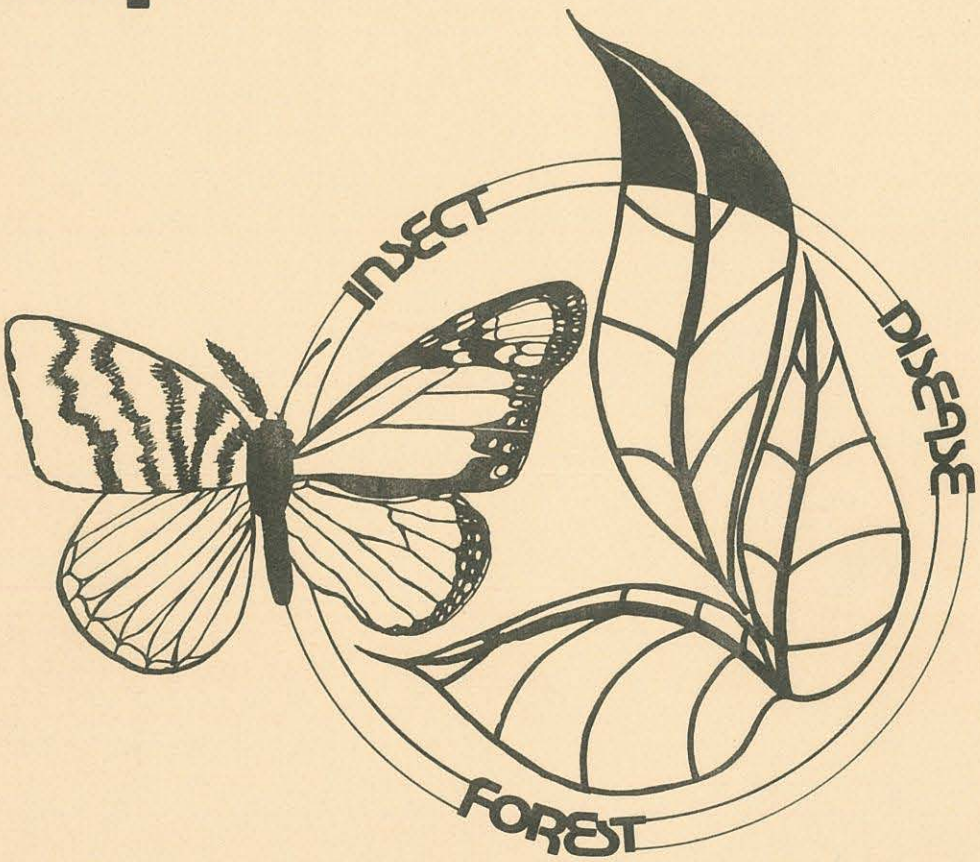
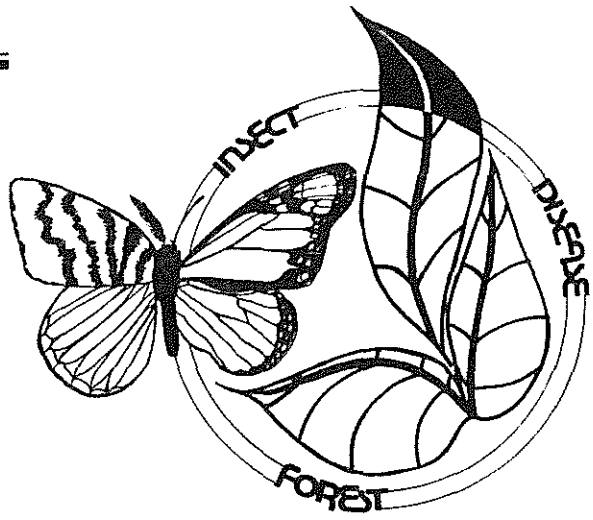
MISSOURI FOREST PEST REPORT

1979



FORESTRY DIVISION
MISSOURI DEPARTMENT OF CONSERVATION

MISSOURI FOREST PEST REPORT 1979



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COVER AND FRONTISPIECE BY JUDY GENTILI

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INSECTS OBSERVED IN 1979

1. Asiatic Oak Weevil, Cyrtepistomus castaneus, (Roelofs)
2. Black Turpentine Beetle, Dendroctonus terebrans, (Oliv.)
3. Bronze Birch Borer, Agrilus anxius, (Gory)
4. Carpenterworm, Prionoxystus robiniae, (Peck)
5. Cottonwood Borer, Plectrodera scalator, (F.)
6. Cottonwood Leaf Beetle, Chrysomela scripta, (F.)
7. Cottonwood Twig Borer, Gypsonoma haimbachiana, (Kft.)
8. Eastern Tent Caterpillar, Malacosoma americanum, (F.)
9. European pine sawfly, Neodiprion sertifer, (Geoff.)
10. Evergreen Bagworm, Thyridopteryx ephemeraeformis (Haw.)
11. Fall Webworm, Hyphantria cunea, (Drury)
12. Green-striped Mapleworm, Anisota rubicunda, (F.)
13. Gypsy Moth, Porthetria dispar, (L.)
14. June Beetle, Phyllophaga sp.
15. Maple Bladder Gall Mite, Vasates quadripedes, (Shimer)
16. Nantucket Pine Tip Moth, Rhyacionia frustrana, (Comst.)
17. Orange-striped Oak Worm, Anisota senatoria, (J. E. Smith)
18. Pales Weevil, Hylobius pales, (Hbst.)
19. Poplar Tent Maker, Ichthyura inclusa, (Hbn.)
20. Red Oak Borer, Enapholodes rufulus, (Haldeman)
21. Redhead Pine Sawfly, Neodiprion lecontei, (Fitch)
22. True Tree Grasshopper, Dendrotettix quercus, (Pack)
23. Two-lined Chestnut Borer, Agrilus bilineatus, (Web.)
24. Walnut Caterpillar, Datana integerrima, (G. and R.)

INSECTS OBSERVED IN 1979 BUT NOT IN REPORT

Harmful Insects

1. Elm Leaf Beetle, Pyrrhalta luteola, (Muller)
2. Hag Moth, Phobetron pithecium, (J. E. Smith)
3. Horn-tailed wasp, Tremex columba, (Linn.)
4. Locust Leaf Miner, Xenochalepus dorsalis, (Thunberg)
5. Native Elm Bark Beetle, Hylurgopinus rufipes, (Eichhoff)
6. Obscure Scale, Melanaspis obscura, (Comstock)
7. Pine Needle Scale, Phenacaspis pinifoliae, (Fitch)
8. Smaller European Elm Bark Beetle, Scolytus multistriatus, (Marsham)
9. Sycamore Lace Bug, Corythuca ciliata (Say)
10. Twig Girdler, Oncideres cingulata, (Say)
11. White pine Bark Aphid, Pineus strobi, (Htg.)
12. Walking Stick, Diapheromera femorata, (Say)

Beneficial Insects

1. Bald-faced Hornet, Vespula maculata, (Linn.)
2. Caterpillar Hunter, Calosoma scrutator
3. Cicada Killer, Sphecius speciosus, (Drury)
4. Ichneumon Wasp, Megarhyssa lunator, (F.)
5. Monarch Butterfly, Danaus plexippus, (L.)
6. Preying Mantis, Stagmomantis carolina, (Johanssen)
7. Wheel Bug, Arilus cristatus, (Linn.)

DISEASES OBSERVED IN 1979

1. Apple Scab, *Venturia inequalis*
2. Brown Spot Needle Blight, *Scirrhia acicola*
3. Diplodia Tip Blight, *Diplodia pinea*
4. Dutch Elm Disease, *Ceratocystis ulmi*
5. Oak Wilt, *Ceratocystis fagacearum*
6. Pine Wilt Disease, *Bursaphelenchus lignicolus*

DISEASES OBSERVED IN 1979 BUT NOT IN REPORT

1. Armillariella Root Rot, *Armillariella mellea*
2. Ash Decline, unknown
3. Bleeding Canker, *Phytophthora cactorum*
4. Cedar-Apple Rust, *Gymnosporangium juniperi-virginianae*
5. Dothistroma Needle Blight, *Scirrhia pini*
6. Eastern Gall Rust, *Cronartium quercum*
7. Elm Phloem Necrosis, virus
8. Fomes Root and Butt Rot, *Fomes annosus*
9. Lophodermium Needle Cast, *Lophodermium pinastri*
10. Maple Anthracnose, *Gleosporium apocryptum*
11. Maple Decline, unknown
12. Oak Anthracnose, *Gnomonia quercina*
13. Oak Leaf Blister, *Taphrina coerulescens*
14. Phomopsis Blight, *Phomopsis juniperovora*
15. Pin Oak Chlorosis, mineral deficiencies
16. Verticillium Wilt, *Verticillium albo-atrum*

The following diseases were observed by S. Olin Phillips, Forest Pathologist, in the Boone County area.

Root Rots

1. Shoe String Root Rot, Armillariella mellea
2. Fomes Root and Butt Rot, Fomes annosus
3. Phytophthora Root Rot of Black Walnut, Phytophthora cinnamoni
4. Ganoderma Root Rot, Ganoderma lucidum
5. White Pine Root Decline, unknown

Stem Problems

1. Cedar Apple Rust, Gymnosporangium juniperi-virginianae
2. Eastern Gall Rust, Cronartium quercum
3. Cedar-Quince Rust, Gymnosporangium clavipes
4. Cedar-Hawthorn Rust, Gymnosporangium globosum
5. Crown Gall, Agrobacterium tumefaciens
6. Bleeding Canker, Phytophthora cactorum
7. Butternut Decline, unknown
8. Nectria Canker, Nectria sp.
9. Fire Blight, Erwinia amylovora
10. Chestnut Blight, Endothia parasitica
11. Strumella Canker, Strumella coryneoidea
12. Crown Canker, Phytophthora cactorum
13. Black Knot, Dibotryon morbosum
14. Walnut Dieback, Melanconium juglandis
15. Mimosa wilt, Fusarium oxysporum f. perniciosum
16. Oak Twig Blight, Physalospora glandicola
17. Bacteria (Twig blight of willow) Pseudomonas saliciperda
18. Wetwood, Erwinia nimipressuralis
19. Dutch Elm Disease, Ceratocystis ulmi
20. Elm Phloem Necrosis, virus

21. Botryosphaeria canker, Botryosphaeria ribis
22. Bark Patch, Aleurodiscus sp.
23. Cercospora Blight, Cercospora sp.
24. Phomopsis Blight, Phomopsis juniperovora
25. Oak Wilt, Ceratocystis fagacearum
26. Verticillium Wilt, Verticillium albo-atrum
27. Sapstreak Disease, Ceratocystis coerulescens
28. Twig Blight, Diplodia sp., Cephalosporium sp., Physalospora sp.
29. Witches Broom, various causes
30. Wood Decay, Polyporus sp., Ganoderma sp., Stereum sp., Fomes sp., Poria sp., Lenzites sp., Daedalea sp.
31. Fusarium Canker, Fusarium solani
32. Damping Off, Pythium sp., Phytophthora sp., Fusarium sp.
33. Brown Rot, Monolinia fructicola
34. Poplar Leaf Rust, Melampsora medusae
35. Pine Wilt Disease, Bursaphelenchus lignicolus

Leaf Problems

1. Sycamore Anthracnose, Gnomonia platani
2. Oak Anthracnose, Gnomonia quercina
3. Maple Anthracnose, Gleosporium apocryptum
4. Hickory Anthracnose, Gnomonia caryae
5. Holly Spot Anthracnose, Elsinoe ilicis
6. Hickory Leaf Blotch, Mycosphaerella dendroides
7. Leaf Blisters, Taphrina sp.
8. Peach Leaf Curl, Taphrina deformans
9. Black Mildew of Oak, Morenoella quercina
10. Actinopelte Leaf Spot, Actinopelte dryina
11. Tar Spots, Rhytisma sp.
12. Leaf Blotch of Buckeye, Guignardia aesculi
13. Apple Scab, Venturia inequalis

14. Needle Rust, Coleosporium asterum

15. Sumac Leaf Spot, Pezizella oenotherae

16. Powdery Mildew, Erisyphe sp., Microsphaera sp., Phyllactinia sp., Podosphaera sp., and Uncinula sp.

17. Leaf Spots, Cercospora sp., Alternaria sp., Gnomonia sp., Cylindrosporium sp., Gleosporium sp., and Actinopelte sp.

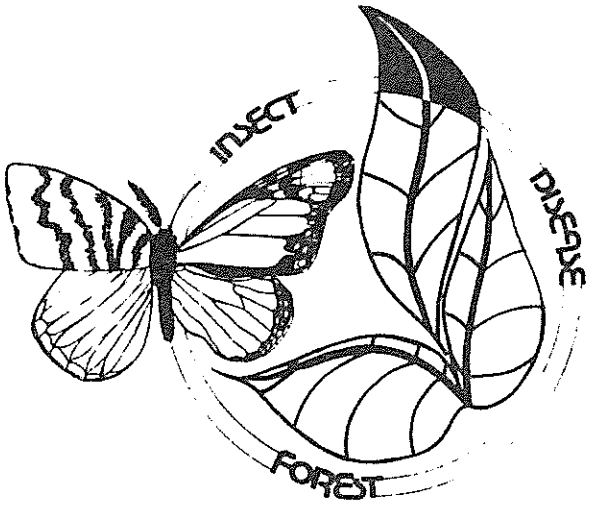
18. Brown Spot Needle Blight, Scirrhia acicola

19. Diplodia Tip Blight, Diplodia pinea

20. Rhizosphaera Needle Cast, Rhizosphaera kalkhoffii

21. Lophodermium Needle Cast, Lophodermium pinastri

22. Dothistroma Needle Blight, Scirrhia pini



STATUS REPORT

1979 FORESTRY DIVISION Volume XVIII

INTRODUCTION

This is our opportunity to bring you news and information about forest insect and disease problems for 1979. Pests included in this report were either a problem in 1978, caused aesthetic damage to urban or forest trees, are a potential problem, endangered the quality of vegetation appearance, or caused log degrade and lumber value loss.

As our Pest Management Program and services available to the public become more popular each year and as you, our readers, become more aware and conscious of bothersome insects and diseases, the number of requests increase. The kind of requests in 1979 varied from drought damage investigation to identification of spiders, mushrooms, and insects.

Trees and shrubs are always at the mercy of the elements. Man can only assist or supplement plant growth and vigor on a small scale, usually only feasible around the home or lot. Forest tree survival is still at the mercy of the elements. Forest stand manipulation is the only answer to controlling insect and disease impact. Too little water at the root zone during the growing season is still the major problem. As a result, scattered tree mortality occurs on drought hazard sites. Rainfall was adequate in spring and early summer, 1979. From middle summer to fall precipitation was spotty and generally light for most of the state. This moisture deficit coupled with the 1976, 1977, and 1978 drought was responsible for scattered mortality of black and scarlet oaks in a number of areas in south Missouri.

Winter moisture, in the form of rain, snow and ice will recharge depleted soil moisture for 1979 and early 1980. What will 1980 bring us in the way of precipitation? We will probably continue to experience tree mortality in cities and in the forest as long as precipitation levels remain extremely low during summer.

Generally speaking, 1979 was normal, marred only by heavy infection by sycamore anthracnose over the state as well as the continuing Dutch elm disease. The looper complex in a eight county area south of St. Louis caused heavy defoliation as well as the green-striped maple worm in various areas over the state. Otherwise no large epidemics or infections occurred in the state.

Noteworthy is the fact that once again no male gypsy moths were found in Missouri during 1979. Apple scab, a foliar disease was a widespread problem on Malus sp. this year.

A new pine disease pine wilt disease, caused by a nematode Bursaphelenchus lignicolus and spread by a long-horned beetle was discovered in Missouri for the first time in 1979. It is believed to have been present but undetected prior to this year.

The Program

In 1962 a cooperative program, the Forest Pest Control Program, was entered into with the U. S. Forest Service by the Forestry Division, Missouri Department of Conservation. Under the original agreement this effort is designed to detect, evaluate or appraise, and control forest insects and diseases on state and private land. Department Foresters and other personnel report occurrences of damaging insects, diseases and animals.

Although difficult to measure, forest insects and diseases have an impact on the forest resource, shade and ornamental trees and Christmas tree production. Some of this damage is degrade to the tree rather than mortality. This degrade may reduce tree quality to a cull grade. Damage by hardwood borers often goes unnoticed by the casual observer, but foresters acknowledge that millions of dollars can be lost through degrade and growth loss by hardwood borers, pine cambial feeders, defoliating insects, vascular diseases and rot.

More subtle but very significant is cumulative stress placed upon forest and shade trees by insects, diseases, drought and other natural and artificial factors. During middle summer and fall, plants suffered from drought stress placed upon them by lack of rainfall. Many plants lost their leaves in August and September. Some of these trees respond to winter moisture. Some will eventually succumb to drought and the Agrilus borer. Some of those trees weakened this summer from drought will be predisposed to possible attacks by primary and secondary insects and wood-rotting fungi. When dry conditions appear imminent, favorite shade trees and shrubs can be helped by deep-watering and broadcast or deep fertilizing. These steps may help increase the vigor of a plant to resist attacks from insects and diseases.

Conditions In Brief

Winter 1978-79, was extremely cold. These low temperatures, ice and deep snows during the winter seemed to have little effect on insect population size during 1979 with the exception perhaps of the Nantucket pine tip moth. Several late killing frosts in spring in the central Ozarks region reduced the fruit crops within the frost zones. Statewide fruit production of native plants was good to moderate. Generally, crops of walnut, hickory, persimmon and acorns were moderate to heavy.

Missouri rainfall for 1979 was generally below average. When precipitation was received later in the year it was late for plant growth during July, August, and September. Often averages and totals can be misleading with regard to availability during the growing season.

Statewide insect and disease problems were scattered and minor in most cases. The walnut caterpillar infested many trees in south and southwest Missouri. The fall webworm occurred in large numbers in south Missouri. The looper complex caused heavy defoliation in eight counties south of St. Louis and the green-striped mapleworm caused heavy defoliation on silver maple in scattered areas over north Missouri.

An extremely moist spring this year provided optimum conditions for the development of foliar diseases. Foliar disease problems were widespread. Another severe winter and drought periods during 1979 continued to cause diebacks and declines on many species.

It is difficult to detect every small infestation or infection in the state. Some detection will be done through December which will not appear in this report.

All pests reported here have been observed and reported by our Department foresters; other Department personnel, Ramon D. Gass, Forest Insect and Disease Specialist, or S. Olin Phillips, Forest Pathologist.

* * * * * * *

Gypsy Moth - No male moths were trapped in over 2,000 traps that were located and monitored over the state by personnel of the State Department of Agriculture, U.S.D.A., A.P.H.I.S. (1,800) and Missouri Department of Conservation (200). Participating in the program were Ray Bruns with Union Electric Company in St. Louis and John Grinstead at Fort Leonard Wood.

Variable Oak Leaf Caterpillar was reported from Newton County on one tree.

Black Turpentine Beetle - Infested weakened sawlog-sized shortleaf pine in six counties where tree mortality was negligible and scattered.

Asiatic Oak Weevil - Infested hardwood forests in south Missouri. Defoliation was common and ranged from three to ten percent of leaf surface.

June Beetle - Infested approximately 10,000 acres in Texas, Dent, and Phelps Counties causing moderate to heavy defoliation of hardwood forests.

True Tree Grasshopper - Continued its south and westward migration from Johnson Mountain in Iron County. Defoliation of hardwoods has occurred as far as Roby and Success in Texas County.

Eastern Tent Caterpillar - was moderate to heavy on black cherry in south Missouri during spring 1979. There were from one to three colonies on many trees where defoliation of newly emerging leaves was complete.

Fall Webworm - Populations were heavy to very heavy in south Missouri in 1979 on walnut, persimmon, hickory, and several other tree species.

Walnut Caterpillar - in northwest, south central and southwest Missouri was responsible for moderate to heavy defoliation of black walnut.

Nantucket Pine Tip Moth - Populations were considerably reduced in 1979 by the severe winter. Third generation was noticeable on shortleaf pine plantings on poor sites out of the natural range.

European Pine Sawfly - populations increased in 1979 and were located in thirteen counties. Moderate to heavy defoliation occurred on Scotch pine in various Christmas Tree Plantations.

Loblolly Pine Sawfly - populations occurred in several counties at very low levels causing negligible defoliation.

Redheaded Pine Sawfly - was found in fourteen counties with defoliation being light to moderate on sapling size plantings.

The Evergreen Bagworm - occurred everywhere pfitzers are planted. Infestations of native eastern red cedar were scattered and varied as to degree of defoliation.

Rhizosphaera Needle Cast - is a continuing problem on spruce in urban plantings. The increase in infection incidence can be linked to optimum moisture conditions.

Bleeding Canker - continued at low levels in 1979. Its greatest impact occurs in ornamental plantings. This disease affects a wide variety of woody species.

Oak Wilt - Increased field surveillance for oak wilt in 1979 brought the number of counties to 48 where positive finds were recorded.

Brown Spot Needle Blight - is an evergrowing problem in Christmas tree plantations. Surveillance of Christmas tree plantations revealed that infection is a rule rather than the exception.

Cedar-Apple Rust - is an annual problem in Missouri. Moist spring weather promotes its occurrence each year.

Apple Scab - was widespread and heavy in the state this year. Ornamental and fruit trees of the apple family were heavily defoliated and fruit production was limited where a regular spray schedule was not used.

Dutch Elm Disease - continued to remain a serious problem causing heavy economic losses in urban areas.

Pine Wilt Disease - caused by a nematode which is spread by a long-horned beetle was found in ten counties in Missouri in 1979. This is the first recorded incidence of the disease in our state.

Sycamore Anthracnose was heavy over the state this spring. Many trees have died or been severely weakened by repeated defoliations caused by this leaf and twig disease.

Diplodia Tip Blight - due to a moist spring was extremely heavy and widespread. This is usually not a severe problem, however, many trees were lost in 1979 due to high infection levels.

Fire Blight - a bacteria which commonly affects plants in the pear and apple family was heavy in many areas of the state in 1979.

Projects

Every opportunity was taken to inform the public of the status of forest and shade tree insects and diseases in the state. This was accomplished through personal contacts and diagnostic service, and through the news media.

Because of our team effort between Forestry Division staff specialists and Department foresters, over 1,700 forest and shade tree requests were serviced over the state in 1979. Staff specialists were available to all foresters and other personnel for assistance. In June, eight regional Pest Management Clinics were held for all Department foresters. These were one-day meetings and were well received by all participants. Staff specialists serviced over 900 pest-related telephone calls. Over 600 diagnoses were made for the state.

No serious problems were detected during periodic visits to seed production areas or Natural Areas.

Periodic visits to the George O. White State Forest Nursery revealed no serious pest problems.

Gass and Phillips conducted detection and evaluation surveys on the major insect and disease problems in 1979 on 4,254,200 acres. Reports were prepared and submitted to the Forest Service.

The presence of the pine wilt nematode problem was observed in ten counties in Missouri during 1979. It is felt that this is not a new problem but has just been discovered and named as the problem. Staff specialists and Department foresters collected core samples for diagnosis from dead and dying Scotch, Austrian, red and Ponderosa pines in their areas. These cores were sent to Plant Pathology, U.S.D.A., A.P.H.I.S., P.P.Q. for positive identification. The problem appears to be endemic at present in Missouri.

A total of seven Forest Insect and Disease Status Reports (March through September) were prepared and sent to all Missouri Christmas Tree Producers, most Department personnel and other individuals totaling 800 copies per month.

Hardwood Borers and Defoliators

Gypsy Moth - Although no moths were collected in traps during 1979 in Missouri, the major effort was to educate the public about the devastating potential of this insect.

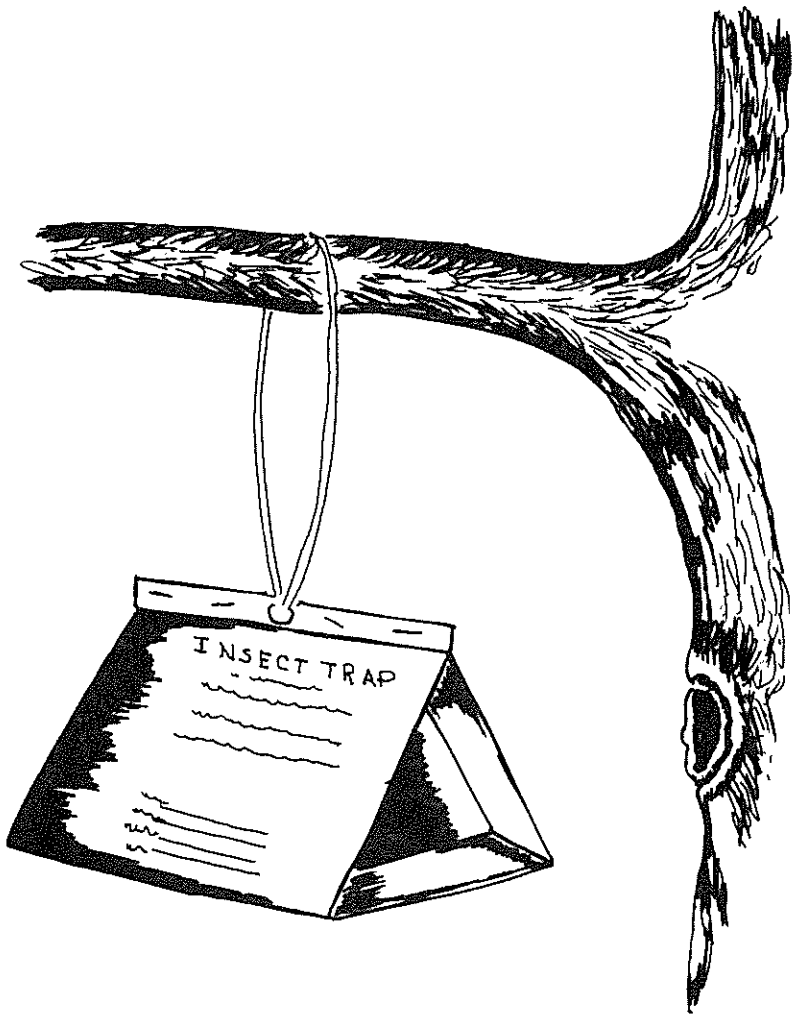


Figure 1: Gypsy Moth Trap

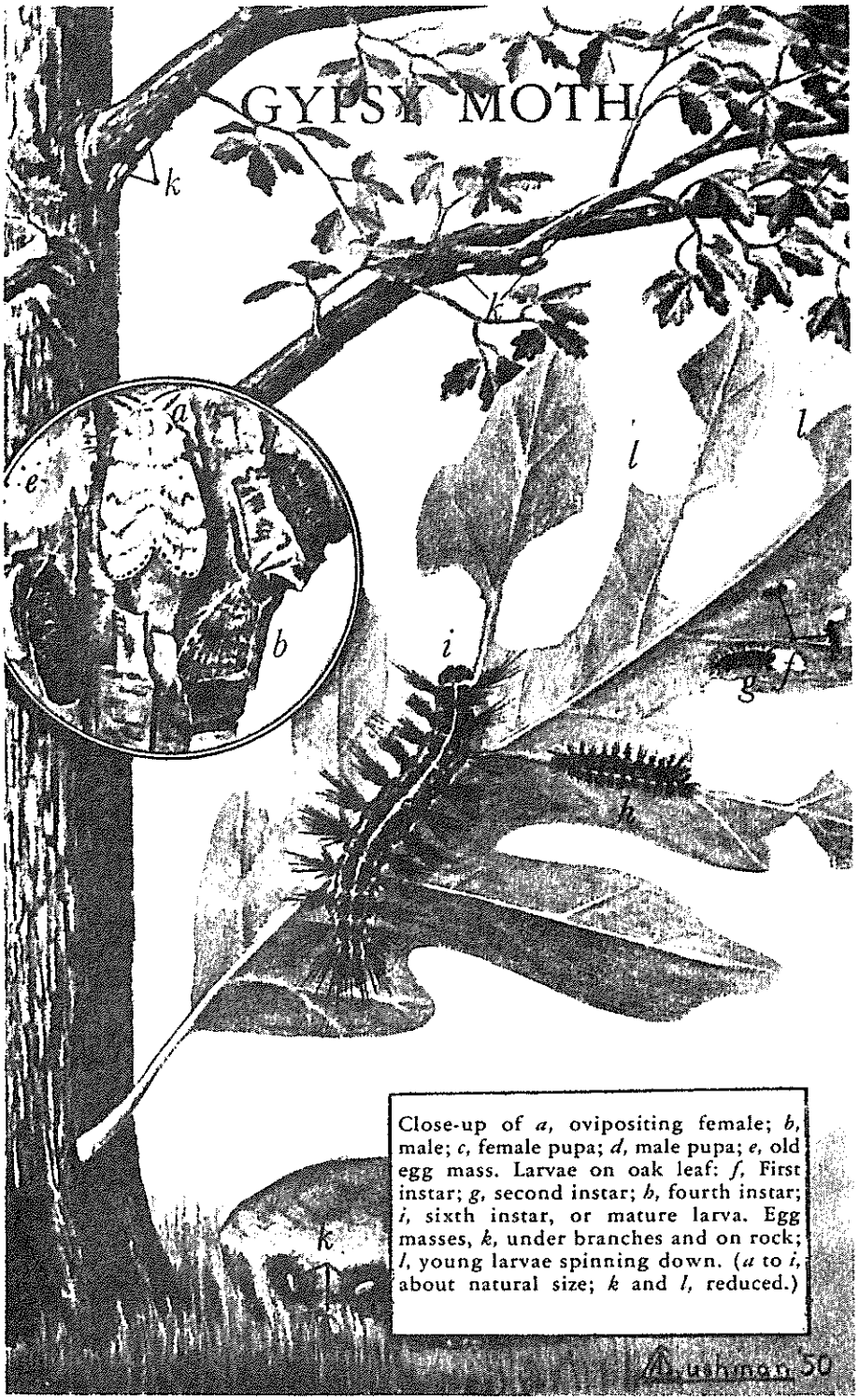

GYPSY MOTH
a
b
c
d
e
f
g
h
i
k
l
Close-up of a, ovipositing female; b, male; c, female pupa; d, male pupa; e, old egg mass. Larvae on oak leaf: f, First instar; g, second instar; h, fourth instar; i, sixth instar, or mature larva. Egg masses, k, under branches and on rock; l, young larvae spinning down. (a to i, about natural size; k and l, reduced.)
Aushman 50

Figure 2 - Life Stages of the Gypsy Moth

The life cycle of the gypsy moth parallels that of a number of other insects. They gypsy moth is not native to the United States and larvae feed on a great variety of hardwood foliage in spring and early summer. Three repeated defoliations may kill hardwood trees. One defoliation may kill evergreen trees.

Gypsy moths overwinter in the egg stage in masses on bark, rocks, litter or on man-made objects.

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Egg masses on tree.

Figure 3 - Gypsy Moth Egg Masses

Variable Oak Leaf Caterpillar - was not detected during 1979.

Trend - populations will remain negligible in 1980.

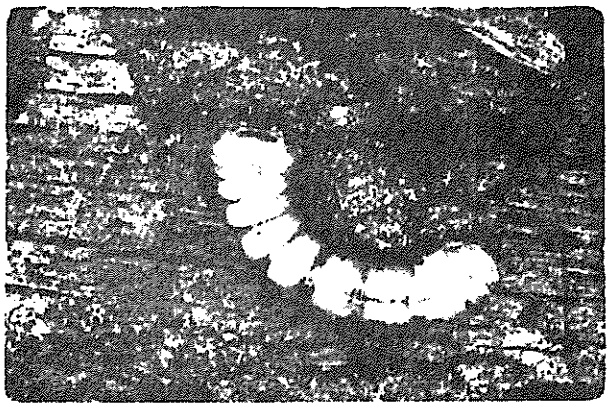

Figure 4 - Red Oak Borer Larva

The Carpenterworm, Red Oak Borer and other living tree hardwood borers continue to infest hardwood trees in forested areas of the state.

Trend - Infestation will continue to occur in trees on poor sites. Estimated dollar loss to hardwood borer degrade amounts to over $800,000.00 annually. Hardwood borers are probably the major insect pest on ornamental plantings.

Suppression - Stand conversion and selective harvest was conducted in various timber sales over the state. Shade tree owners controlled borers in high value trees on a limited basis.

The Bronze Birch Borer continued to infest many European white birch yard trees over the state. Infestation was especially heavy in central Missouri causing decline and mortality of weakened trees. Plants are usually weakened due to moisture deficits. The bronze birch borer is traditionally a secondary attacker, infesting weakened birch. The Two-lined Chestnut Borer traditionally attacks weakened oak in south Missouri where moisture stress was a problem. Oak mortality was a problem caused by a number of factors including drought, late frost damage, coupled with two-lined chestnut borer infestations.

Trend - Both borers will continue to kill birch and oaks during and several years following our present drought cycle.

Suppression - is not feasible under forest conditions. Drought hazard sites can be recognized and special management techniques conducted on these sites. These may consist of clear cutting and allowing the same species to return. On some areas it might be more economical to convert from oak to shortleaf pine within the natural pine range. The selection system may be used to reduce basal area, favoring the more tolerant species using a shorter rotation. It may be desirable to grow a normal basal area volume per acre and use the entomological and pathological rotation.

The Cottonwood Twig Borer, Cottonwood Borer, Cottonwood Leaf Beetle and Poplar Tent Maker continue to infest cottonwood where it grows. Borer damage is greater on trees growing on poor sites. Defoliation by the poplar tent maker occurs almost everywhere on cottonwood.

Trend - no increase in infestation is anticipated in 1979.

Suppression - no control was conducted for any of these pests in 1979.

* * * * * * *

True Tree Grasshopper continued its south and west spread from Johnson Mountain in Iron County. It is causing defoliation from five to twenty percent of infested crowns of white oak and several other species. Activity is still present from the Johnson Mountain site where it began in late 1960 to and beyond Roby and Success in Texas County in 1979. To date no tree mortality has been observed as a result of defoliation by the grasshopper.

Trend - This insect will continue to spread from Success south and west. Insect virus or parasites may be responsible for its collapse as populations build.

Suppression - No suppression work was carried out for this insect.

* * * * * * *

Asiatic Oak Weevil was widespread and very abundant in Missouri in 1979. Defoliation ranged from between five and twenty percent on forest and shade trees alike. Defoliation has been light enough which has not resulted in mortality of any trees. This insect is a household nuisance being attracted to lights and screen doors at night.

Trend - populations will continue to increase in size in 1980.

Suppression - there is not practical control for the beetle under forest conditions.

* * * * * * *

Fall Webworm infestation state-wide was heavy. Many areas in southwest Missouri were heavily infested. Defoliation and webbing was heavy on walnut, persimmon, hickory, sycamore, and several other species. Many saplings were completely enveloped by webs.

Trend - moderate to heavy defoliation should continue in 1979 in many areas of the state.

Suppression - Area-wide control of the fall webworm is not environmentally or economically feasible with our present knowledge. Individual colony control was conducted by owners of shade trees and nut orchards.

Figure 5 - Larvae and Web of Eastern Tent Caterpillar

Eastern Tent Caterpillar occurred on black cherry in moderate to heavy amounts in spring 1979. Webbing amounted from one to as many as three on many black cherry trees.

Trend - Webbing will compare in 1980 to that of 1979. This is another insect that cannot be controlled area-wide because of environmental problems.

Suppression - Shade tree owners removed webs from trees in some areas of the state.

* * * * * * *

Walnut Caterpillar populations were moderate to heavy in southwest Missouri on black walnut in 1979. In other areas infestations were light to moderate.

Trend - 1980 populations should compare with those of 1979.

Suppression - Few plantation and orchard owners sprayed their trees for this insect.

* * * * * * *

Figure 6 - Gall of Maple Bladder Gall Mite on Silver Maple

Maple Bladder Gall Mite - was reported on silver maple from several parts of the state. Infestation was generally light in 1979.

* * * * * * *

Green Striped Mapleworm - was responsible for heavy defoliation in three areas of the state near St. Joseph-Kansas City, in Central Missouri and south of Hannibal. Reports were received indicating temporary polluting of streams by dead larvae and droppings which resulted in temporary putrefaction of the water. This caused temporary mortality of fish in polluted portions of the affected streams.

Trend - populations are expected slightly to build during spring of 1980.

Suppression - A number of shade tree owners sprayed their trees for control of this insect. Forest-wide chemical control is not economically feasible nor environmentally sound.

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Orange-Striped Oak Worm occurrence was negligible during 1979.

Trend - populations will remain low in 1980.

Suppression - no control was necessary.

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The Looper Complex - developed south of St. Louis in Jefferson, Washington, St. Francois, Ste. Genevieve, Perry, Madison, St. Charles, and Franklin Counties. By May 10, most feeding was complete. Where defoliation occurred it was heavy on white oak and post oak. Among this complex of insects were the Linden looper and spring cankerworm.

Populations of large green beetles were noted in association with the loopers. The Calosoma scrutator (Fabricius) or ground beetles were observed feeding readily upon looper larvae.

Trend - Populations are expected to compare in 1980 to those of 1979.

Suppression - No control was conducted in 1979.

* * * * * * *

The June Beetle was responsible for moderate to heavy defoliation of hardwood trees over 10,000 acres in Texas, Dent, and Phelps Counties in early June, 1979. Populations of beetles stripped trees and accumulated in deep piles on the ground. This was particularly bothersome around farmsteads from the presence of the beetles in such large numbers.

Trend - Populations will be large again in 1980 locally around the state. No serious problems are anticipated however.

Suppression - Because of its sporadic unpredictability, control is difficult for this insect.

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PINE TRUNK BORERS, TWIG BORERS AND TERMINAL FEEDERS

Nantucket Pine Tip Moth and related species were very light in 1979. Scattered shortleaf pine plantings out of the natural range were moderately infested by third generation tip moth. Once again, severe 1978-1979 winter was responsible for freezing of overwintering pupae, thus reducing first and second generations this summer.

Trend - Populations are expected to be very low again in 1980.

Suppression - no feasible chemical controls are available to plantation owners.

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Black Turpentine Beetle infested shortleaf pine in a number of counties this year. Lightning-struck trees attracted beetles in several cases. Only single trees were infested over the botanical range of shortleaf pine. Infestation was subnormal this year for Missouri conditions.

Trend - light infestations are predicted where shortleaf pine have been disturbed or are in a weakened condition.

Suppression - where infestations occurred, recommendations were made to fell trees and either salvage or burn.

* * * * * * *

Pales Weevil infested Scotch pine Christmas tree plantings in Jackson, Cass, Henry, Greene, Christian, Howard, Adair and Warren Counties in 1979. Bark feeding was heavy on scattered trees but no disfigurement or major flagging occurred.

Trend - Pales will continue to infest scattered plantations where cultural and chemical controls are not used.

Suppression - Christmas tree producers continue to treat their stumps with various materials to discourage egg laying.

* * * * * * *

PINE DEFOLIATORS

European Pine Sawfly occurred on Christmas tree plantations in fourteen counties in 1979. Defoliation ranged from light to heavy in the various plantations. As a project this May, over 30,000 sawfly larvae were collected from District Forester, Ed Keyser's plantation near Kirksville placed in paper bags and sent to Dr. Frank Lewis in Hamden, Connecticut. Dr. Lewis used these larvae for his research project in developing a virus which can be labelled and used on the control of the European pine sawfly.

Trend - Populations are expected to increase in 1980.

Suppression - A number of Christmas tree producers sprayed for this insect.

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Redheaded Pine Sawfly was present on shortleaf pine in south Missouri in plantations. Defoliation was light to moderate in these plantations. See distribution map in appendix.

Trend - populations should increase slightly in 1980.

Suppression - only limited control work was accomplished on plantings around Department tower sites.

* * * * * * *

Evergreen Bagworm - Populations were high over the state on ornamental upright evergreens. Natural occurring eastern redcedar seemed to fare well with infestations being very light in a few areas. Ornamental pfitzer junipers were heavily hit.

Trend - heavy infestations of ornamental evergreens will continue in 1980.

Suppression - Many ornamental owners had their evergreens sprayed on a contract basis by tree service firms.

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FOREST AND ORNAMENTAL TREE DISEASES

Oak Wilt - was detected in 48 counties during the 1979 growing season. This large increase over 1978 reports was due to increased field surveillance. Oak wilt continues to spread into urban plantings where losses are economically important. Infections under forest conditions cause scattered widespread insignificant volume losses.

Trend - Oak wilt is endemic in Missouri. Although it is of economic importance in urban areas, it is not a serious disease of Missouri's hardwood forests.

Suppression - sanitation controls are the most feasible at present.

* * * * * * *

Apple Scab - was a widespread problem this year on flowering crabs and other related plants. This problem caused defoliation of affected trees which reduced fruit production. Refoliation did occur and owners using a regular spray schedule were able to maintain vigor of their trees.

Trend - The noticeable increase in infection this year can be associated with climatic conditions. The extremely moist spring in 1979 was optimum for development of foliar diseases. Future infection will depend on the variables of climatic conditions.

Suppression - Chemical control was used by individual landowners with good results.

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Brown Spot Needle Blight - is increasing in distribution each year. The average Scotch pine Christmas tree plantation appears to be infected with brown spot. Certain Christmas tree plantations suffer substantial losses annually. This problem can be solved by eventually replacing susceptible varieties with disease resistant ones.

Trend - This will continue to spread within and between plantations each year. Significant losses will occur annually.

Suppression - Integrated control practices emphasizing both cultural and chemical control programs have been implemented by growers throughout the state.

* * * * * * *

Dutch Elm Disease - continues to cause significant economic losses in urban areas. Replacement and removal costs account for the majority of the annual loss of approximately two million dollars in the state. These losses will occur until the last American elms are gone.

Trend - Very high levels of Dutch elm disease will continue.

Suppression - Sanitation is the major control method used in the state. Some injection work is conducted on a limited basis.

* * * * * * *

Sycamore Anthracnose - was extremely heavy over most of the state in 1979. Repeated defoliation of trees during 1978 and 1979 caused dieback, decline and mortality of many urban and forest trees. Mortality will continue if infection is heavy in 1980.

Trend - The disease has been widespread and heavy during 1978 and 1979. Its link to climatic conditions make predictions for the future difficult. A large supply of inoculum is available for reinfection in the spring of 1980.

Suppression - Forest-wide control of sycamore anthracnose is not feasible. It is found wherever sycamore grows.

* * * * * * *

Diplodia Tip Blight - is widespread across the state on spruce, fir, Scotch pine and oaks. Older Austrian pines (30 years) usually become susceptible to this disease.

Trend - High infection incidence and damage can be linked with spring moisture. Future infection rates will hinge upon spring moisture.

Suppression - Preventative chemical applications were used by private owners over the state.

* * * * * * *

Pine Wilt Disease - is a newly discovered pest problem in Missouri. Mortality is caused by the nematode, Bursaphelenchus lignicolus which is transmitted from an infested to a healthy tree by a long-horned beetle. The widespread detection of this disease, in 10 counties in 1979, indicates that it has been a problem but has just been identified. It is a serious problem on Japanese black pine and red pine in Japan and will probably continue to kill older Scotch pine in Missouri.

Trend - According to past history of Scotch pine mortality in Missouri, it is predicted that it will continue at endemic levels.

Suppression - The present recommended control is to remove and destroy infested trees as they die.

* * * * * * *

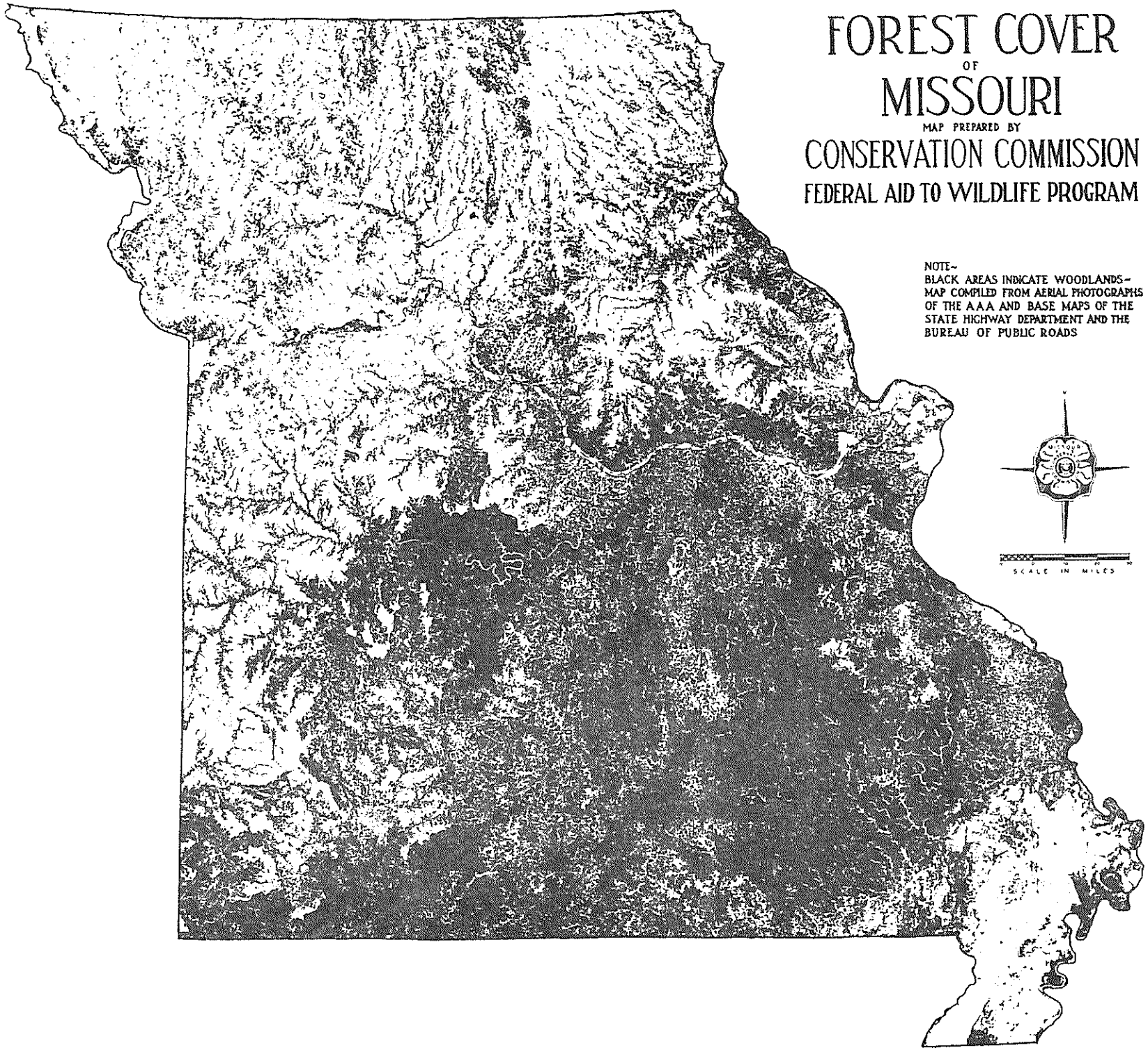
CONCLUSION

Late summer drought, the looper complex, the hardwood borer problem, the pine wilt nematode problem, the green-striped mapleworm, oak wilt, brown spot needle blight, and sycamore anthracnose were the most glaring problems during 1979. Winter moisture will relieve drought stress in 1980. By the beginning of growing season, 1980, soil should be recharged with normal levels of moisture.

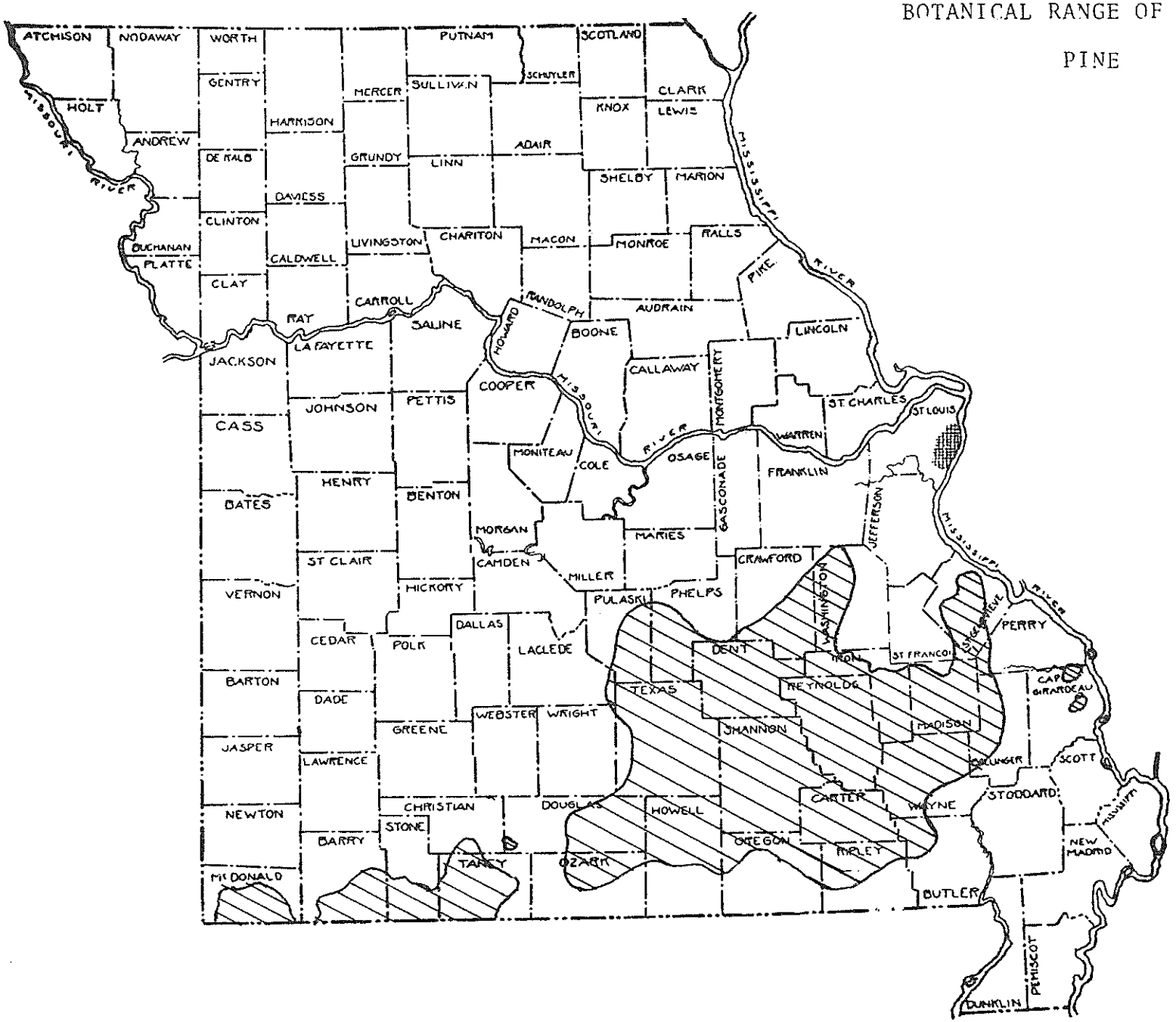
CONCLUSION continued...

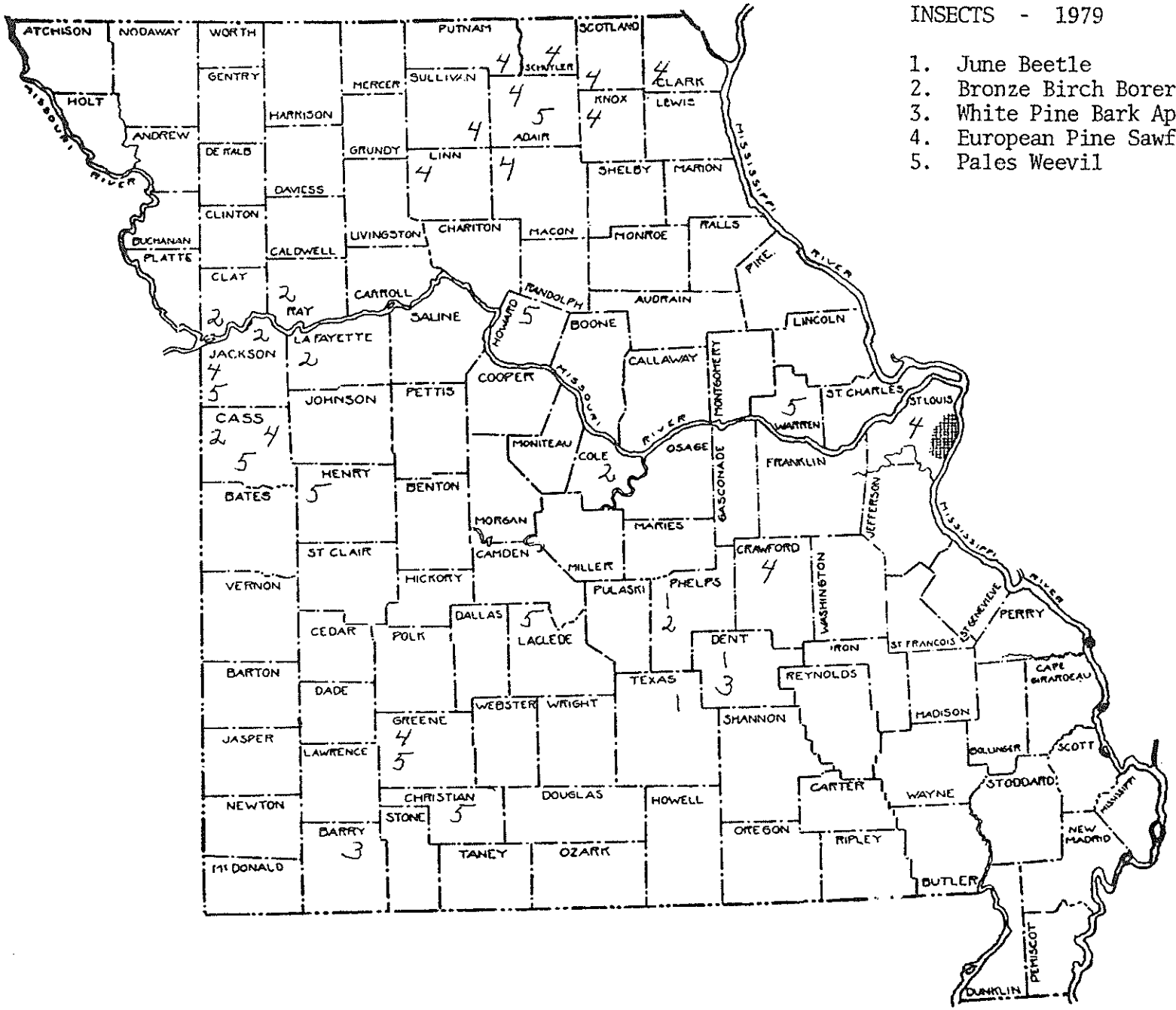
Activities during 1979 were directed toward informing our foresters and assisting the public in their awareness of forest insect and disease conditions over the state. This year 1979, again, was a busy one, informing the public of insect and disease conditions and of the gypsy moth threat in the midwest. Much was accomplished through personal contact with various groups, via radio programs and through educational displays at fairs.

The most significant and personally rewarding of all activities was working with the public and Department personnel and providing service to all who sought answers to their pest problems. This service is available to every citizen of the state. We appreciate the assistance of those foresters who submitted reports and observations about pests and those who kept a watchful eye on the forests on their districts. Their efforts made the Forest Insect and Disease Management Program more effective and meaningful.


FOREST COVER
OF
MISSOURI
MAP PREPARED BY
CONSERVATION COMMISSION
FEDERAL AID TO WILDLIFE PROGRAM
NOTE~
BLACK AREAS INDICATE WOODLANDS~
MAP COMPILED FROM AERIAL PHOTOGRAPHS
OF THE A.A.A. AND BASE MAPS OF THE
STATE HIGHWAY DEPARTMENT AND THE
BUREAU OF PUBLIC ROADS
SCALE IN MILES

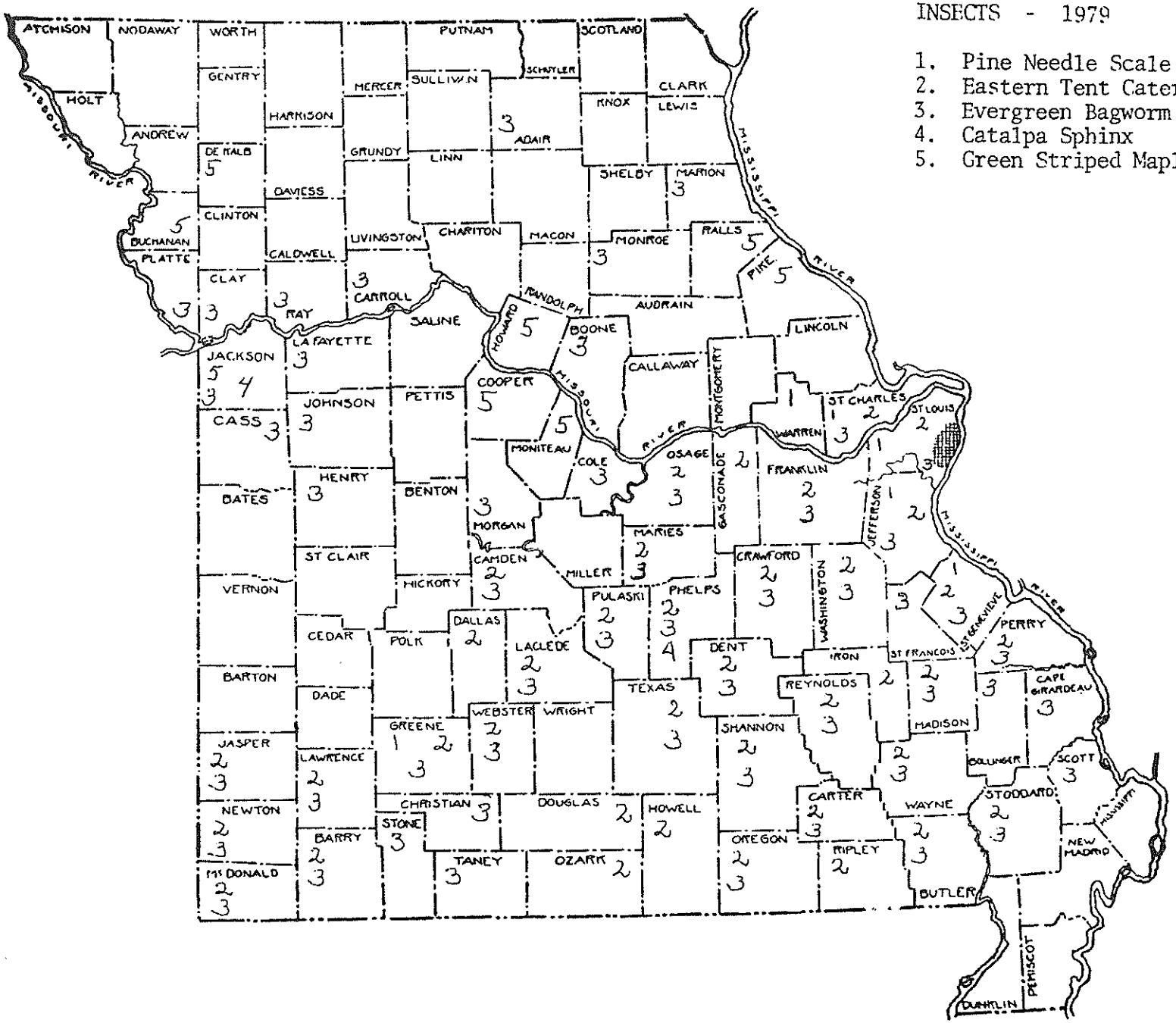
BOTANICAL RANGE OF SHORTLEAF PINE





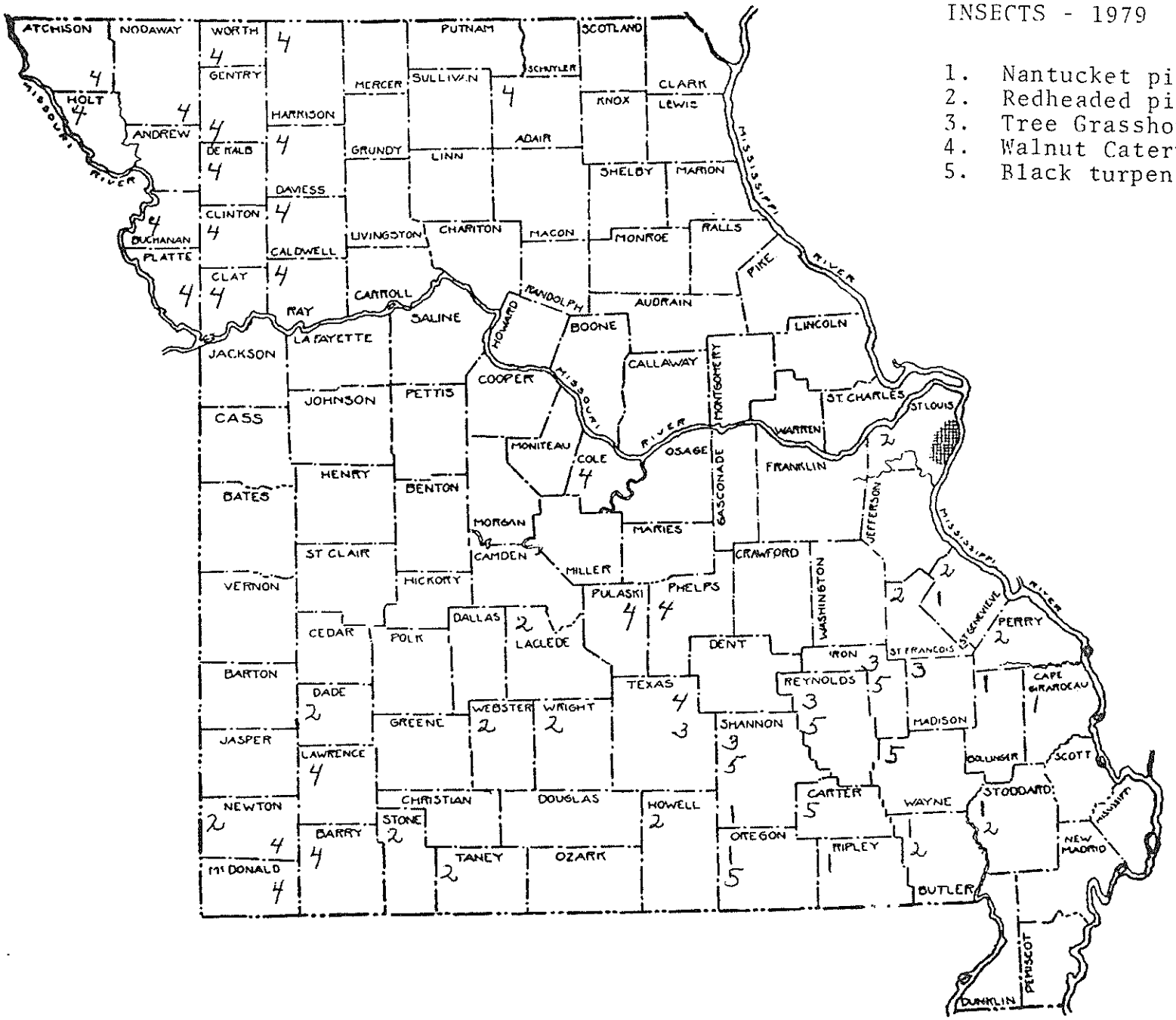
INSECTS - 1979

1. June Beetle
2. Bronze Birch Borer
3. White Pine Bark Aphid
4. European Pine Sawfly
5. Pales Weevil



INSECTS - 1979

1. Pine Needle Scale
2. Eastern Tent Caterpillar
3. Evergreen Bagworm
4. Catalpa Sphinx
5. Green Striped Mapleworm

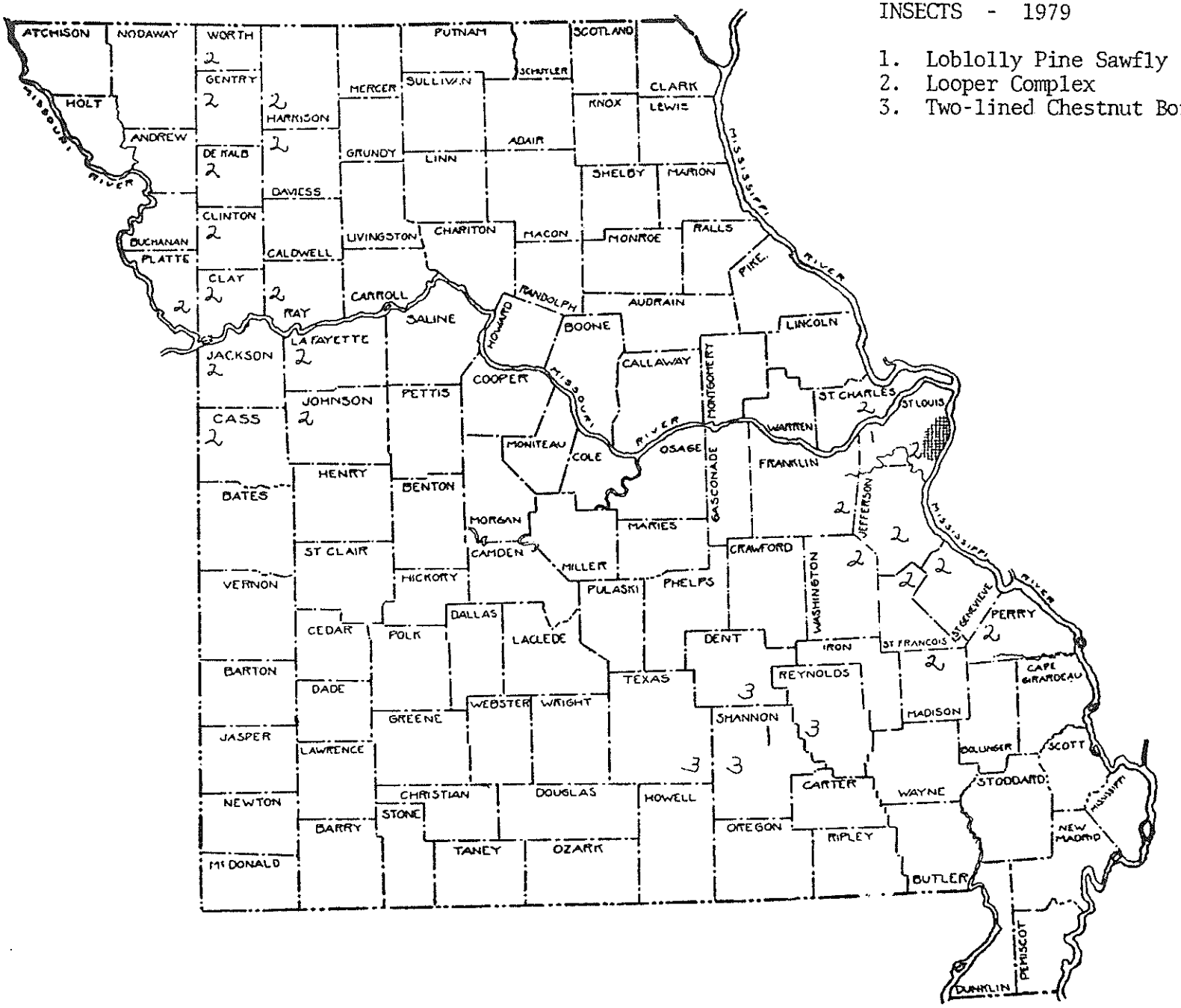


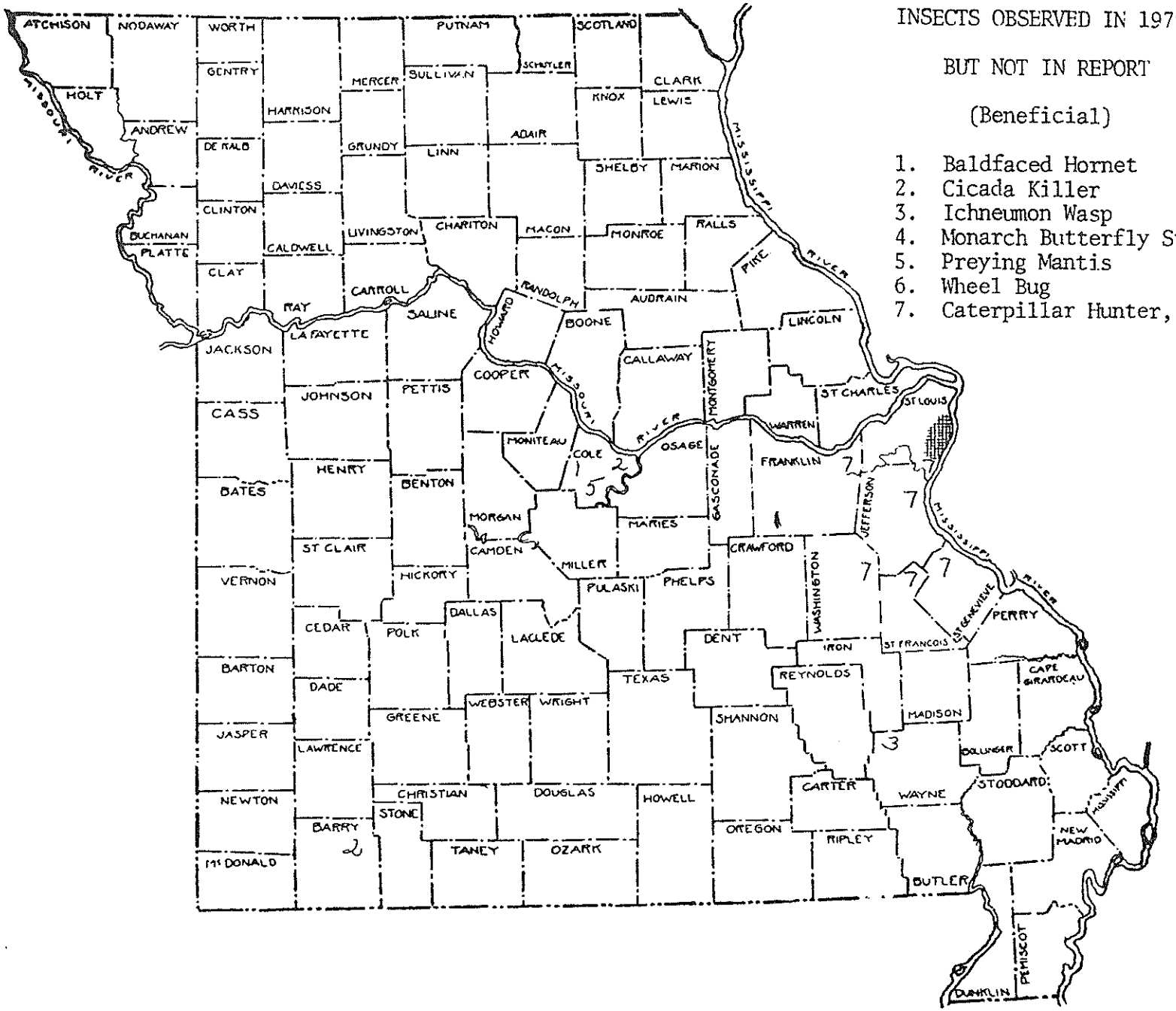
INSECTS - 1979

1. Nantucket pine tip moth
2. Redheaded pine sawfly
3. Tree Grasshopper
4. Walnut Caterpillar
5. Black turpentine beetle

INSECTS - 1979

1. Loblolly Pine Sawfly
2. Looper Complex
3. Two-lined Chestnut Borer





INSECTS OBSERVED IN 1979

BUT NOT IN REPORT

(Beneficial)

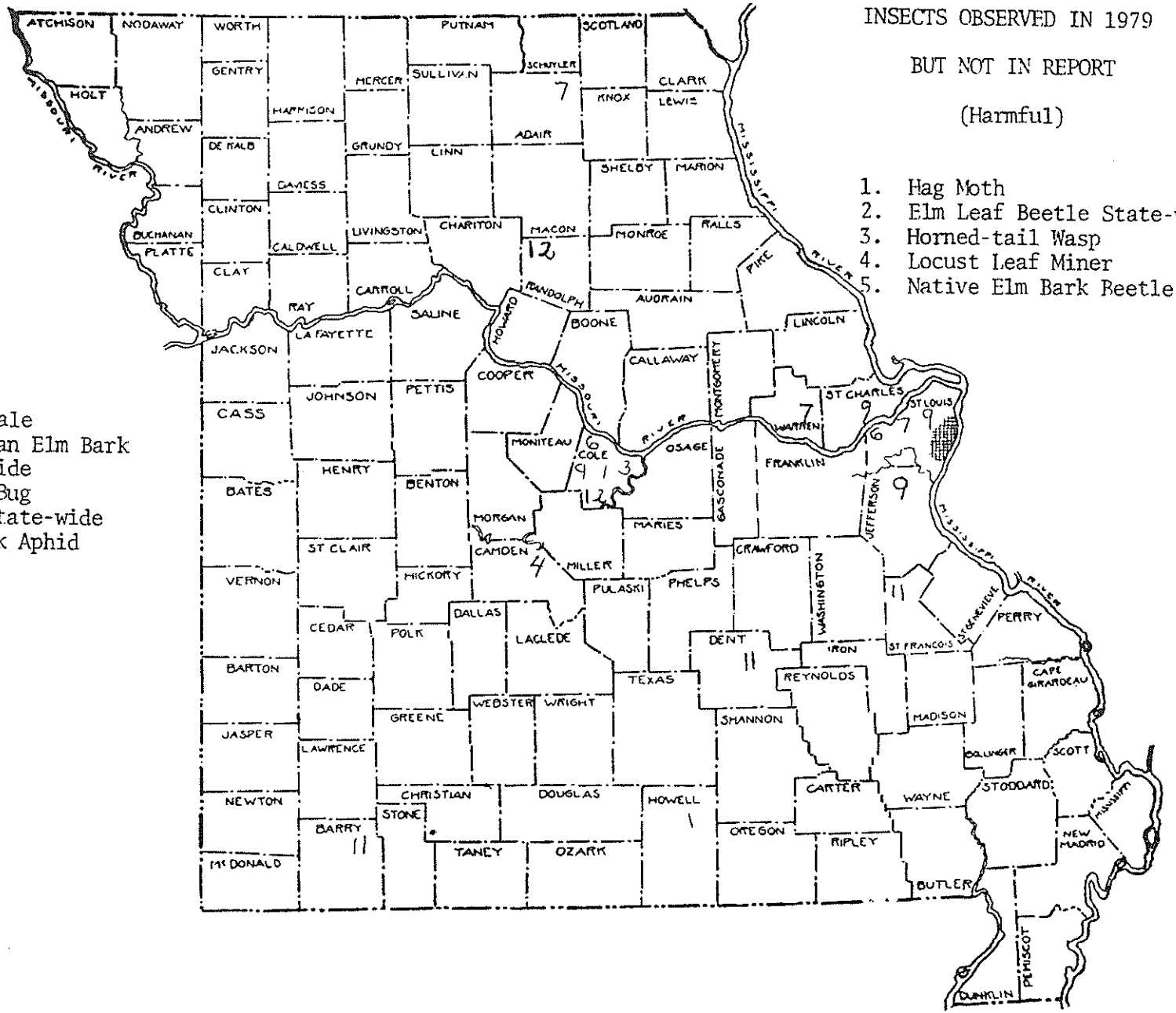
1. Baldfaced Hornet
2. Cicada Killer
3. Ichneumon Wasp
4. Monarch Butterfly State-wide
5. Preying Mantis
6. Wheel Bug
7. Caterpillar Hunter, Calosoma scrutator

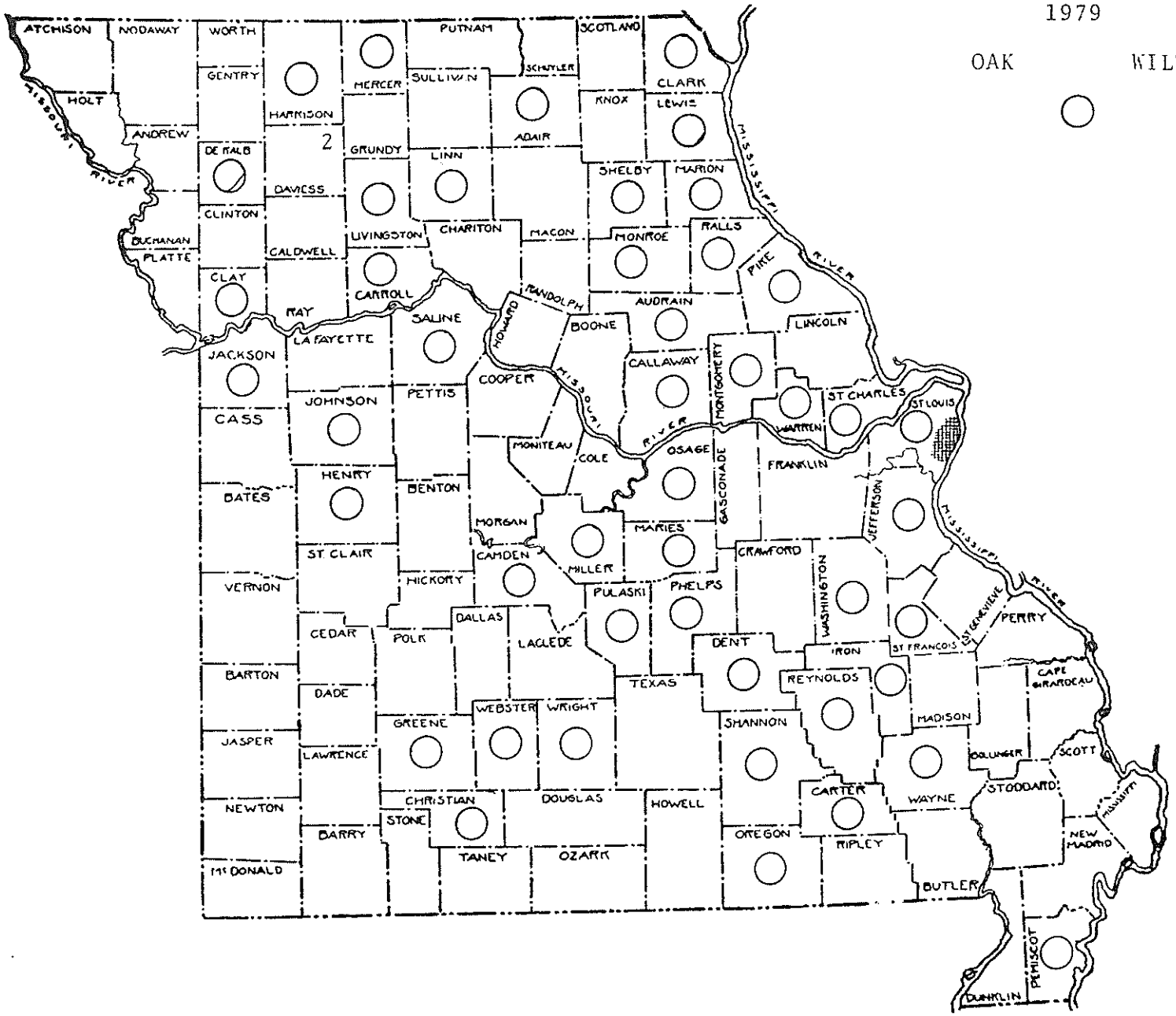
INSECTS OBSERVED IN 1979

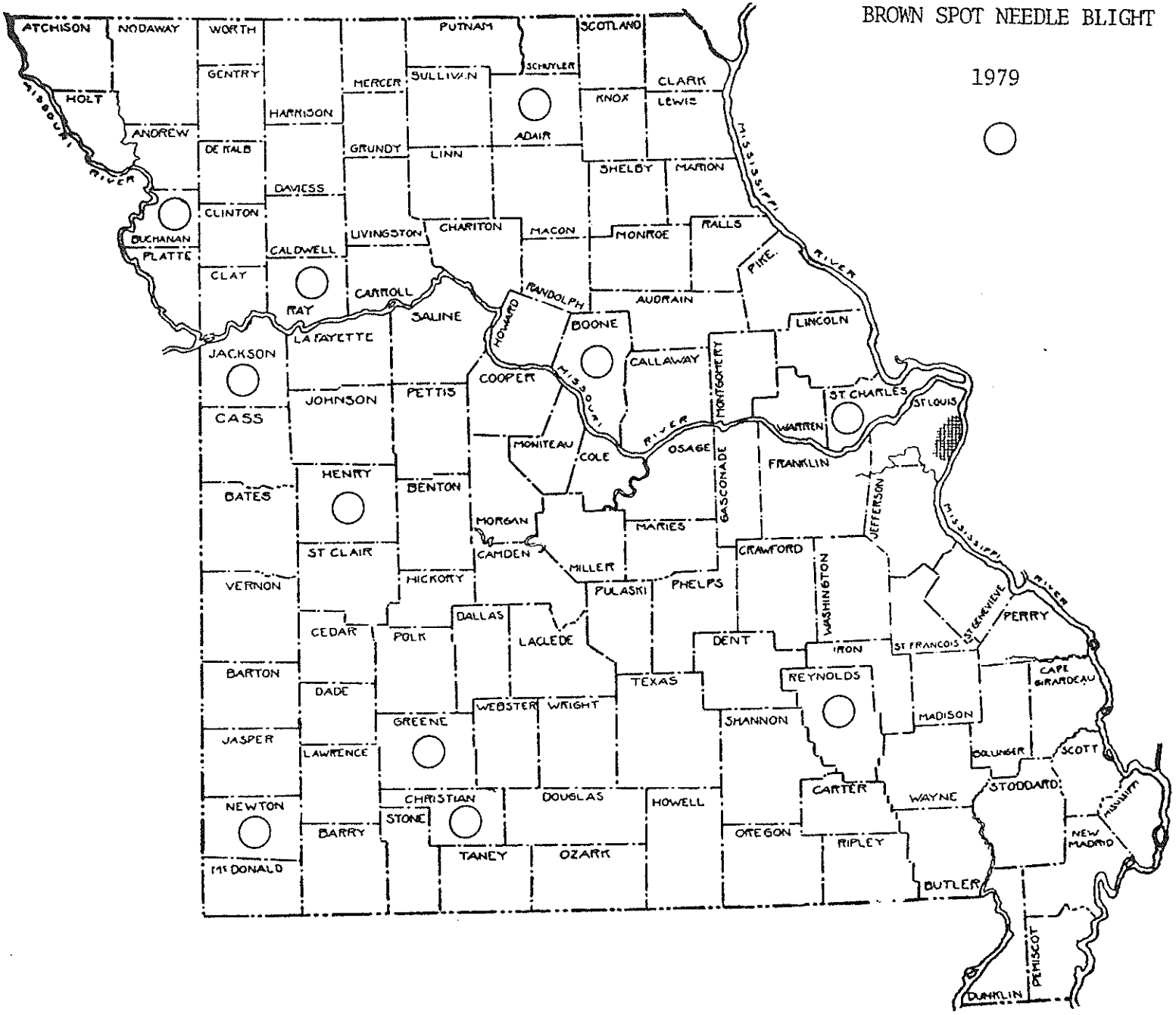
BUT NOT IN REPORT

(Harmful)

1. Hag Moth
2. Elm Leaf Beetle State-wide
3. Horned-tail Wasp
4. Locust Leaf Miner
5. Native Elm Bark Beetle State-wide
6. Obscure Scale
7. Pine Needle Scale
8. Smaller European Elm Bark Beetle State-wide
9. Sycamore Lace Bug
10. Twig Girdler State-wide
11. White Pine Bark Aphid
12. Walking Stick




1979
OAK WILT
ATCHISON
NODAWAY
WORTH
PUTNAM
SCOTLAND
CLARK
GENTRY
MERCER
SULLIVAN
SCHUYLER
KNOX
LEWIS
HOLT
HARRISON
ADAIR
ANDREW
DE KALB
GRUNDY
LINN
SHELBY
MARION
DAVIESS
CLINTON
LIVINGSTON
CHARITON
MACON
MONROE
RALLS
BUCHANAN
PLATTE
CALDWELL
PIKE
CLAY
CARROLL
RANDOLPH
AUDRAIN
RAY
SALINE
BOONE
LINCOLN
LAFAYETTE
HOWARD
JACKSON
COOPER
CALLAWAY
MONTGOMERY
ST CHARLES
ST LOUIS
JOHNSON
PETTIS
CASS
MONITEAU
COLE
OSAGE
WARREN
FRANKLIN
HENRY
BENTON
BATES
MORGAN
GASCONADE
JEFFERSON
MARIES
ST CLAIR
CAMDEN
MILLER
CRAWFORD
VERNON
HICKORY
PULASKI
PHELPS
WASHINGTON
CEDAR
POLK
DALLAS
LACLEDE
DENT
IRON
ST FRANCOIS
STE GENEVIEVE
PERRY
BARTON
TEXAS
REYNOLDS
CAPE GIRARDEAU
DADE
GREENE
WEBSTER
WRIGHT
SHANNON
MADISON
JASPER
LAWRENCE
BOLLINGER
SCOTT
CARTER
WAYNE
STODDARD
NEWTON
CHRISTIAN
DOUGLAS
HOWELL
STONE
BARRY
OREGON
RIPLEY
NEW MADRID
TANEY
OZARK
McDONALD
BUTLER
DUNKLIN
PEMISCOT
MISSOURI RIVER
MISSISSIPPI RIVER


BROWN SPOT NEEDLE BLIGHT
1979
ATCHISON
NODAWAY
WORTH
PUTNAM
SCOTLAND
SCHUYLER
CLARK
KNOX
LEWIS
GENTRY
MERCER
SULLIVAN
HOLT
HARRISON
ADAIR
ANDREW
DE KALB
GRUNDY
LINN
SHELBY
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LIVINGSTON
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RALLS
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CASS
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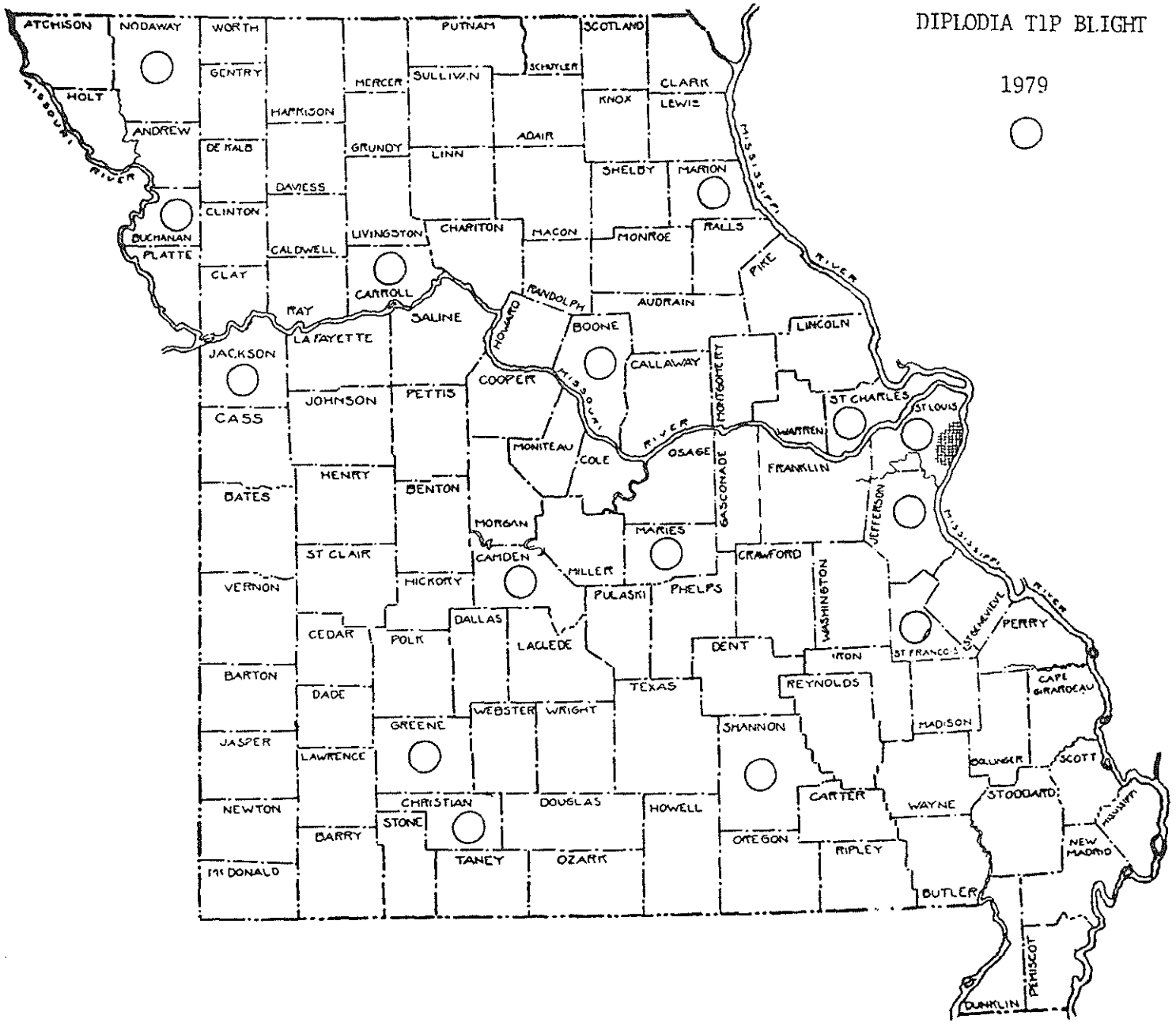
COLE
OSAGE
FRANKLIN
HENRY
BENTON
BATES
GASCONADE
JEFFERSON
MORGAN
MARIES
ST CLAIR
CAMDEN
MILLER
CRAWFORD
HICKORY
PULASKI
PHELPS
WASHINGTON
VERNON
STE GENEVIEVE
PERRY
CEDAR
POLK
DALLAS
LACLEDE
DENT
IRON
ST FRANCOIS
BARTON
TEXAS
REYNOLDS
CAPE GIRARDEAU
DADE
WEBSTER
WRIGHT
SHANNON
MADISON
GREENE
JASPER
LAWRENCE
BOLLINGER
SCOTT
CARTER
WAYNE
STODDARD
CHRISTIAN
DOUGLAS
HOWELL
NEWTON
STONE
OREGON
NEW MADRID
BARRY
RIPLEY
TANEY
OZARK
McDONALD
BUTLER
PEMISCOT
DUNKLIN

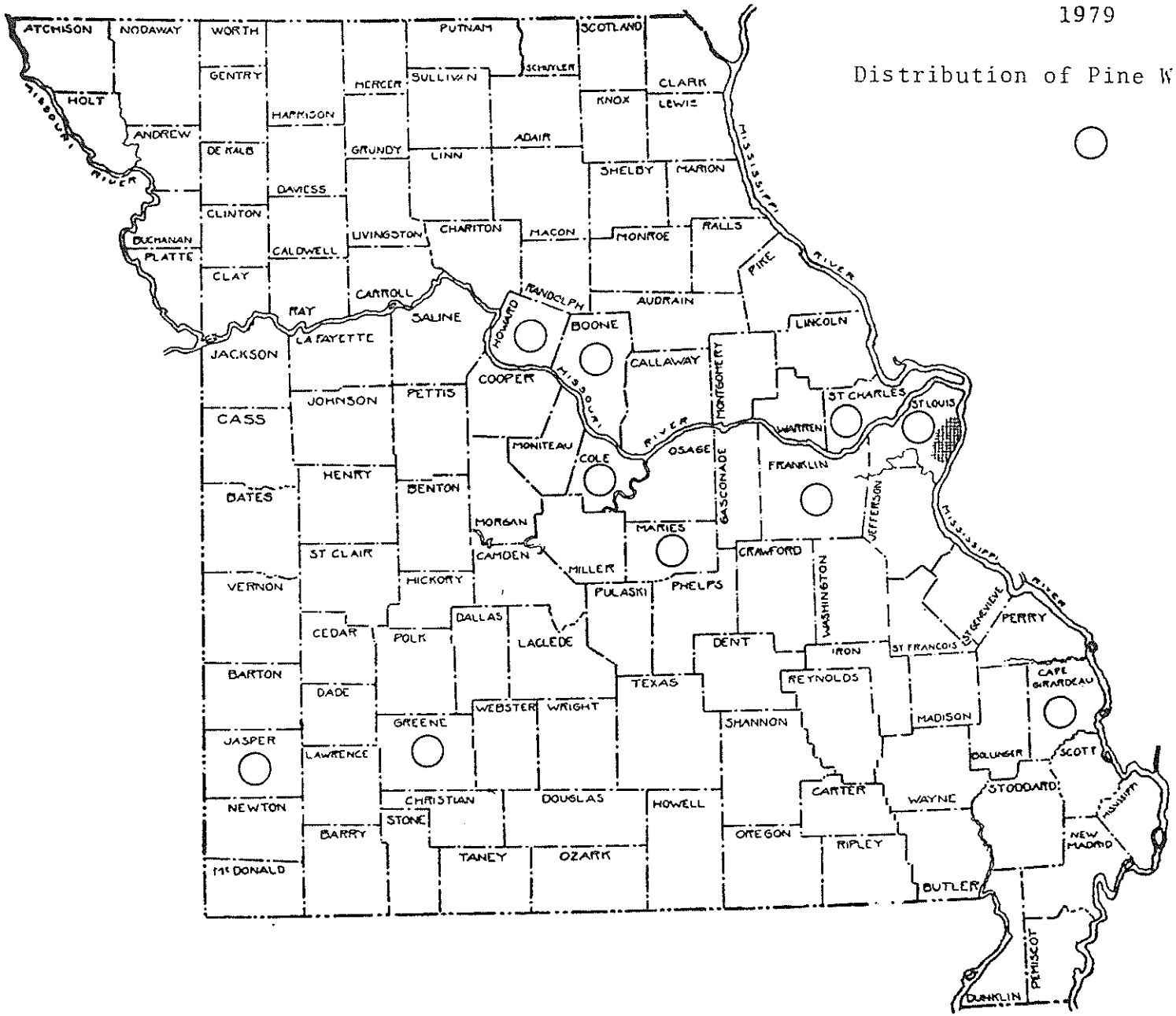
DIPLODIA TIP BLIGHT

1979



1979

Distribution of Pine Wilt Disea

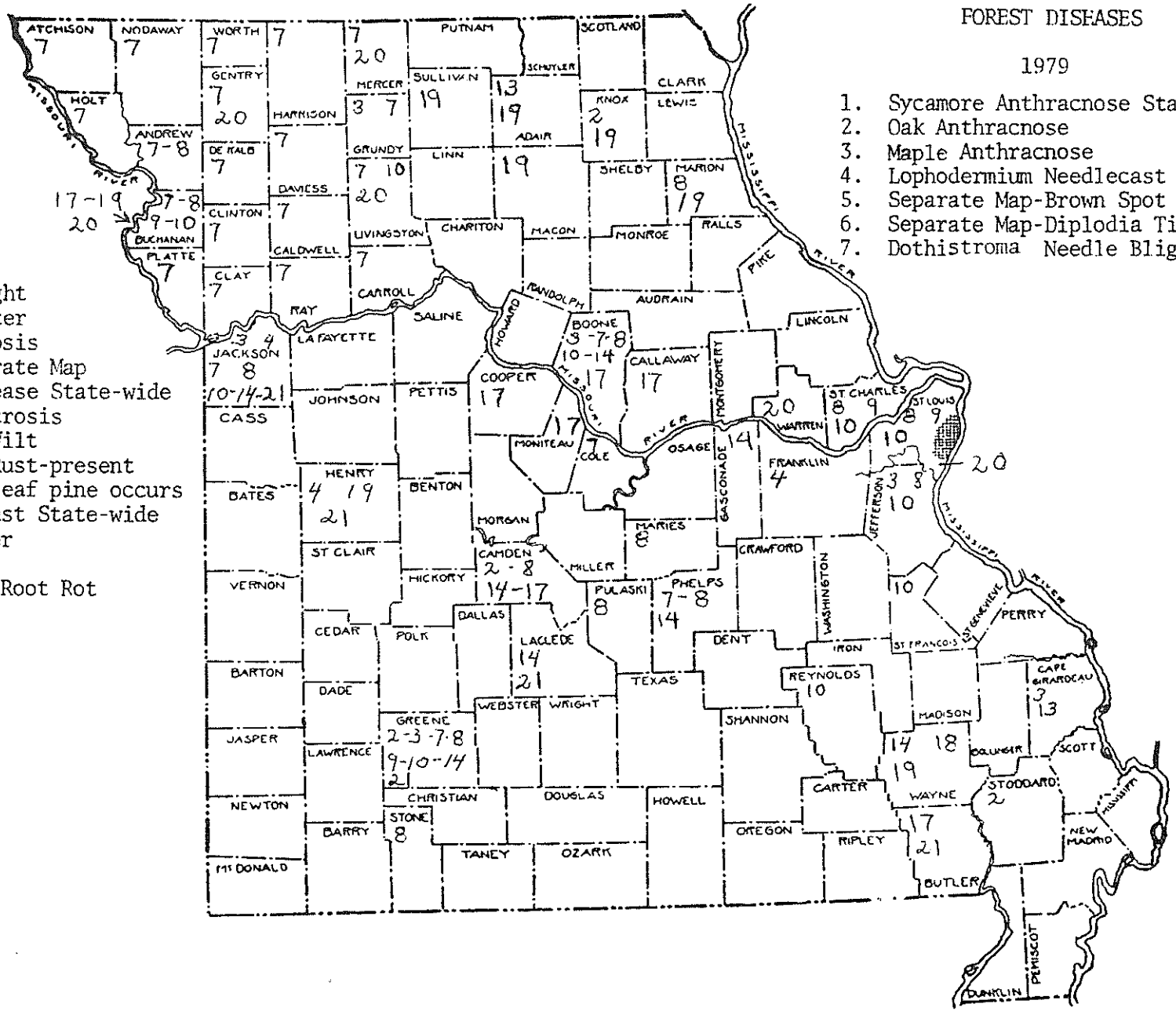


FOREST DISEASES

1979

1. Sycamore Anthracnose State-wide
2. Oak Anthracnose
3. Maple Anthracnose
4. Lophodermium Needlecast
5. Separate Map-Brown Spot Needle Blig
6. Separate Map-Diplodia Tip Blight
7. Dothistroma Needle Blight

8. Phomopsis Blight
9. Oak Leaf Blister
10. Pin Oak Chlorosis
11. Oak Wilt-Separate Map
12. Dutch Elm Disease State-wide
13. Elm Phloem Necrosis
14. Verticillium Wilt
15. Eastern Gall Rust-present where shortleaf pine occurs
16. Cedar Apple Rust State-wide
17. Bleeding Canker
18. Fomes Annosus
19. Armellariella Root Rot
20. Ash Decline
21. Maple Decline



INCIDENTAL OCCURRENCE OF DISEASES

1979

A. Cytospora canker
B. Wetwood
C. Apple Scab
D. Black Canker of Willow
E. Leaf Blotch of Buckeye
F. Ink Spot
G. White Mold of Hickory
H. Black Knot State-wide

I. Tar Spot
J. Fire Blight State-wide
K. Pine Needle Rust
L. Sapsucker Damage State-wide
M. Heart Rot State-wide
N. Crown Gall
O. Walnut Anthracnose State-wide
P. Ash Anthracnose
Q. White Pine Blister Rust
R. Witches Broom